INTERNATIONAL EJER CONGRESS

ejercongress.org

XI International Eurasian Educational Research Congress

CONFERENCE PROCEEDINGS

XI INTERNATIONAL EURASIAN

EDUCATIONAL RESEARCH CONGRESS

EJERCONGRESS 2024
CONFERENCE PROCEEDINGS

May 21-24, 2024/ Kocaeli University - Türkiye

Editor

Distinguished Professor Şenel POYRAZLI,

Penn State University, USA

INTERNATIONAL EJER CONGRESS

XI. INTERNATIONAL EURASIAN EDUCATIONAL RESEARCH CONGRESS

EJERCONGRESS 2024

CONFERENCE PROCEEDINGS

May 21-24, 2024/ Kocaeli University - Turkiye

by Anı Publishing

Kızılırmak Sokak 10/A Çankaya/ Ankara - Turkiye 06680

Tel : 90 312 425 81 50 pbx

Fax : 90 312 425 81 11

www.ejercongress.org
www.ejercongress@gmail.com

e-ISBN : 978-625-97716-6-3

Congress Committees

Honorary Members of Congress

Prof. Nuh Zafer CANTÜRK, Kocaeli University Rector, TURKIYE

Prof. Veysel SÖNMEZ, EJER Founding Editor, TURKIYE

Congress Presidents

Ord. Prof. Şenel POYRAZLI, Penn State University, USA

Prof. Elif ÇELEBİ ÖNCÜ, Dean of Kocaeli University Faculty of Education, TURKIYE

Organizing Committee Chair

Prof. Esma BULUŞ KIRIKKAYA, Kocaeli University Faculty of Education, TURKIYE

Congress Vice-President and Network Coordinator

Prof. Funda NAYIR, Ağrı İbrahim Çeçen University, TURKIYE

Congress Secretaries

Aleyna PİŞİREN

Murat KARA

Media Manager

Hilal DOĞRUKARTAL AKÇAKAYA

Members of the Organizing Committee

Prof. Dr. Abdulkadir MASKAN, Dicle University, TURKIYE

Prof. Dr. Ekber TOMUL, Mehmet Akif Ersoy University, TURKIYE

Prof. Dr. Esma BULUŞ KIRIKKAYA, Kocaeli University, TURKIYE

Prof. Dr. Funda NAYIR, Ağrı İbrahim Çeçen University, TURKIYE

Prof. Dr. İbrahim Soner YILDIRIM, Middle East Technical University, TURKIYE

Prof. Dr. Kazım ÇELİK, Pamukkale University, TURKIYE

Prof. Dr. Mehmet GÜVEN, Gazi University, TURKIYE

Prof. Dr. Necdet KONAN, İnönü University, TURKIYE

Prof. Dr. Selahattin GELBAL, Hacettepe University, TURKIYE

Prof. Dr. Tuncay AKÇADAĞ, Fatih Sultan Mehmet University, TURKIYE

Prof. Dr. Turan Akman ERKILIÇ, Anadolu University, TURKIYE

Assoc. Prof. Dr. Aslı EŞME, Kocaeli University, TURKIYE

Assoc. Prof. Dr. Belgin ÖZAYDINLI, Kocaeli University, TURKIYE

Assoc. Prof. Dr. Coşkun KÜÇÜKTEPE, Istanbul University – Cerrahpaşa, TURKIYE

Assoc. Prof. Dr. Derya KALTAKÇI GÜREL, Kocaeli University, TURKIYE

Assoc. Prof. Dr. Dilek FİDAN, Kocaeli University, TURKIYE

Assoc. Prof. Dr. Fatih KEZER, Kocaeli University, TURKIYE

Assoc. Prof. Dr. Fırat Kıyas BİREL, Dicle University, TURKIYE

International Organizing Committee

Executive Board

Res. Asst. Eylül Balâ ALTUNAY, Kocaeli University, TURKIYE

Res. Asst. Samet GÖÇ, Kocaeli University, TURKIYE

Res. Asst. Saffet ARSLAN, Kocaeli University, TURKIYE

Res. Asst. Özge OKUL, Kocaeli University, TURKIYE

Res. Asst. Sevda Nur AÇIKGÖZ, Kocaeli University, TURKIYE

Res. Asst. Büşra TOMRUKCU, Kocaeli University, TURKIYE

Res. Asst. Ufuk SARIDEDE, Kocaeli University, TURKIYE

Res. Asst. PhD Birsen Berfu AKAYDIN, Kocaeli University, TURKIYE

Res. Asst. Dilara YILMAZ CAN, Kocaeli University, TURKIYE

Science Committee

Prof. Abdulkadir MASKAN
Prof. Abdurrahman TANRIÖĞEN
Prof. Adnan KAN
Prof. Agnaldo ARROIO
Prof. Ahmet IŞIK
Prof. Ali TAŞ
Prof. Alper ÇİLTAŞ
Prof. Andrey A. KISELNIKOV
Prof. Anita PIPERE
Prof. Antonio E. PUENTE
Prof. Arda ARIKAN
Prof. Arif SARIÇOBAN
Prof. Armağan ERDOĞAN
Prof. Asiye İVRENDİ
Prof. Asuman DUATEPE PAKSU
Prof. Atılgan ERÖZKAN
Prof. Atilla CAVKAYTAR
Prof. Ayfer ALPER
Prof. Aynur BOZKURT BOSTANCI
Prof. Aysel KÖKSAL AKYOL
Prof. Ayşe BALCI KARABOĞA
Prof. Ayşe ÇAKIR İLHAN
Prof. Ayşe Esra ASLAN
Prof. Ayşe OĞUZ ÜNVER
Prof. Ayşen BAKİOĞLU
Prof. Ayşenur BÜYÜKGÖZE KAVAS
Prof. Baki DUY
Prof. Bayram AŞILIOĞLU
Prof. Belgin ELMAS
Prof. Berrin BAYDIK
Prof. Binnur GENÇ İLTER
Prof. Buket AKKOYUNLU
Prof. Burhanettin DÖNMEZ
Prof. Bülent AYDOĞDU
Prof. C. Ergin EKİNCİ
Prof. Canan LAÇİN ŞİMŞEK
Prof. Celal BAYRAK
Prof. Cem BALÇIKANLI
Prof. Christian FALTIS
Prof. Christoph WULF
Prof. Çağla GÜR
Prof. Çağlar ÇAĞLAR
Prof. Çiğdem HASER
Prof. Çiğdem Ünal
Prof. Neşe TERTEMİZ
Prof. Nilgün METİN
Prof. Nilüfer Havva VOLTAN ACAR
Prof. Nurettin ŞAHİN
Prof. Nurgül AKMANOĞLU
Prof. Oktay ASLAN
Prof. Orhan KARAMUSTAFAOĞLU
Prof. Oya YERİN GÜNERİ
Prof. Özgül YILMAZ TÜZÜN
Prof. Özgür Erdur BAKER
Prof. Özlem KORAY
Prof. Paul GIBBS
Prof. Pınar SARPKAYA
Prof. Ragıp ÖZYÜREK
Prof. Rahime Nükhet ÇIKRIKÇI
Prof. Ramazan SEVER
Prof. Renan SEZER
Prof. Ruhi SARPKAYA
Prof. Ruken AKAR VURAL
Prof. Sadegül AKBABA ALTUN
Prof. Sadık KARTAL
Prof. Sait AKBAŞLI
Prof. Sait BULUT
Prof. Salih ŞAHİN
Prof. Sedat UÇAR
Prof. Sefa BULUT
Prof. Selahattin GELBAL
Prof. Selahattin KAYMAKÇI
Prof. Semra ERKAN
Prof. Servet ÖZDEMİR
Prof. Seval ERDEN ÇINAR
Prof. Sevgi ÖZGÜNGÖR
Prof. Sezer CİHANER KESER
Prof. Sibel GÜNEYSU
Prof. Soner YILDIRIM
Prof. Süleyman İNAN
Prof. Sven PERSSON
Ord. Prof. Şenel POYRAZLI
Prof. Şevki KÖMÜR
Prof. Şükran KILIÇ
Prof. Şükran TOK
Prof. Şükrü ADA
Prof. Taner ALTUN
Prof. Tao WANG
Assoc. Prof. Hüseyin ERGEN
Assoc. Prof. İlke Önal ÇALIŞKAN
Assoc. Prof. İlker CIRIK
Assoc. Prof. Jacqueline GUSTAFSON
Assoc. Prof. Kamil YILDIRIM
Assoc. Prof. Laura M. Reid MARKS
Assoc. Prof. M. Cem BABADOĞAN
Assoc. Prof. Martha LASH
Assoc. Prof. Mehmet SAĞLAM
Assoc. Prof. Mehmet TEYFUR
Assoc. Prof. Mehmet ULAŞ
Assoc. Prof. Melek ALTIPARMAK KARAKUŞ
Assoc. Prof. Meral HAKVERDİ CAN
Assoc. Prof. Meryem ALTUN EKİZ
Assoc. Prof. Mesut GÜN
Assoc. Prof. Murat AKYILDIZ
Assoc. Prof. Mustafa BABADOĞAN
Assoc. Prof. Mustafa ERGUN
Assoc. Prof. Mustafa KIŞOĞLU
Assoc. Prof. Nazan KAYTEZ
Assoc. Prof. Necdet AYKAÇ
Assoc. Prof. Nedim ÖZDEMİR
Assoc. Prof. Nermin KARABACAK
Assoc. Prof. Nesrin SÖNMEZ
Assoc. Prof. Nihan DEMİRKASIMIOĞLU
Assoc. Prof. Oğuzhan DALKIRAN
Assoc. Prof. Okan BULUT
Assoc. Prof. Onur ÇALIŞKAN
Assoc. Prof. Osman Tayyar ÇELİK
Assoc. Prof. Özden Şahin İZMİRLİ
Assoc. Prof. Özlem TAGAY
Assoc. Prof. Pınar BAĞÇELİ KAHRAMAN
Assoc. Prof. Pınar FETTAHLIOĞLU
Assoc. Prof. Pınar ŞAFAK
Assoc. Prof. Ramin Aliyev
Assoc. Prof. Recep ERCAN
Assoc. Prof. Refik TURAN
Assoc. Prof. Saadet KURU ÇETİN
Assoc. Prof. Sabahat BURAK
Assoc. Prof. Sedat ŞEN
Assoc. Prof. Sedef CANBAZOĞLU BİLİCİ
Assoc. Prof. Sezai KOÇYİĞİT
Assoc. Prof. Seval EMİNOĞLU KÜÇÜKTEPE
Assoc. Prof. Sibel AKIN SABUNCU

Prof. Danny WYFFELS
Prof. David BRIDGES
Prof. David GURALNICK
Prof. Demet Yaylı
Prof. Deniz GÜRÇAY
Prof. Derya ARSLAN ÖZER
Prof. Donna MERTENS
Prof. Ender DURUALP
Prof. Erdal HAMARTA
Prof. Ersen YAZICI
Prof. Esen UZUNTİRYAKİ
Prof. Esma BULUŞ KIRIKKAYA
Prof. Esmahan AĞAOĞLU
Prof. Esra BUKOVA GÜZEL
Prof. Eyüp ARTVİNLİ
Prof. F. Çağlayan DİNÇER
Prof. Fatma AÇIK
Prof. Fatma BIKMAZ
Prof. Fatma ÇALIŞANDEMİR
Prof. Fatma ÇELİK KAYAPINAR
Prof. Fatma MIZIKACI
Prof. Fatma SEGGIE
Prof. Fatma SUSAR KIRMIZI
Prof. Feride BACANLI
Prof. Feyyat GÖKÇE
Prof. Figen ÇOK
Prof. Gelengül HAKTANIR
Prof. Gerry MCNAMARA
Prof. Gıyasettin DEMİRHAN
Prof. Gökay YILDIZ
Prof. Gökhan ÇETİNKAYA
Prof. Gülsün ATANUR BASKAN
Prof. Gürcü ERDAMAR
Prof. Hafize KESER
Prof. Hakan ATILGAN
Prof. Haluk ÖZMEN
Prof. Hasan ARSLAN
Prof. Hasan COŞKUN
Prof. Hasan DEMİRTAŞ
Prof. Hatice BAKKALOĞLU
Prof. Hülya GÜR
Prof. Hülya ŞAHİN BALTACI
Prof. Hüseyin ÇALIŞKAN
Prof. Hüseyin YOLCU
Prof. İlknur Çifci TEKİNARSLAN
Prof. İlknur MAYA
Prof. İnayet AYDIN
Prof. İsmail AYDOĞAN
Prof. İsmail Hakkı DEMİRCİOĞLU
Prof. İsmail KARAKAYA
Prof. James BANKS
Prof. Kasım KARAKÜTÜK
Prof. Kazım ÇELİK
Prof. Kerim GÜNDOĞDU
Prof. Kürşat ERBAŞ
Prof. Kyunghwa LEE
Prof. Lütfi ÜREDİ
Prof. Macid MELEKOĞULU
Prof. Mediha SARI
Prof. Theo WUBBELS
Prof. Tohit GÜNEŞ
Prof. Tolga ERDOĞAN
Prof. Tuba ÇENGELCİ KÖSE
Prof. Tuğba YANPAR YELKEN
Prof. Tuncay AKÇADAĞ
Prof. Tuncay ERGENE
Prof. Turan PAKER
Prof. Tülin Güler YILDIZ
Prof. Türkay Nuri TOK
Prof. Ursula CASANOVA
Prof. Ümit ŞAHBAZ
Prof. Vesile ALKAN
Prof. Vesile SOYYİĞİT
Prof. Vivienne BAUMFİELD
Prof. Yahya ALTINKURT
Prof. Yasemin AYDOĞAN
Prof. Yasemin ERGENEKON
Prof. Yasemin KIRKGÖZ
Prof. Yaşar KONDAKÇI
Prof. Yıldız KIZILABDULLAH
Prof. Yusif MAMMADOV
Prof. Yusuf ŞAHİN
Prof. Yüksel KAVAK
Prof. Zeynep KARATAŞ
Assoc. Prof. Adem PEKER
Assoc. Prof. Adile SARANLI
Assoc. Prof. Ali KIŞ
Assoc. Prof. Ali Korkut ULUDAĞ
Assoc. Prof. Alper YETKİNER
Assoc. Prof. Arslan BAYRAM
Assoc. Prof. Aydan ORDU
Assoc. Prof. Ayhan BABAROĞLU
Assoc. Prof. Aysel ÇOBAN
Assoc. Prof. Bahadır NAMDAR
Assoc. Prof. Bahadır YILDIZ
Assoc. Prof. Baki ŞAHİN
Assoc. Prof. Banu AKTÜRKOĞLU
Assoc. Prof. Banu ALTUNAY
Assoc. Prof. Behçet ÖZNACAR
Assoc. Prof. Behsat SAVAŞ
Assoc. Prof. Berna CANTÜRK GÜNHAN
Assoc. Prof. Birsel AYBEK
Assoc. Prof. Burcu ÖZDEMİR BECEREN
Assoc. Prof. Bülent ÇETİNKAYA
Assoc. Prof. Canay DEMİRHAN İŞCAN
Assoc. Prof. Cihat DEMİR
Assoc. Prof. Coşkun KÜÇÜKTEPE
Assoc. Prof. Davut SARITAŞ
Assoc. Prof. Derya YILDIZ
Assoc. Prof. Didem KILIÇ
Assoc. Prof. Didem KOŞAR
Assoc. Prof. Emine DURMUŞ
Assoc. Prof. Emine ZEHRA TURAN
Assoc. Prof. Emrah GÜL
Assoc. Prof. Emre ER
Assoc. Prof. Engin ADER
Assoc. Prof. Ergül DEMİR
Assoc. Prof. Erkan KÜLEKÇİ
Assoc. Prof. Sibel KAZAK
Assoc. Prof. Simla COURSE
Assoc. Prof. Sinan KOÇYİĞİT
Assoc. Prof. Sonnur KÜÇÜK KILIÇ
Assoc. Prof. Şemseddin GÜNDÜZ
Assoc. Prof. Temel TOPAL
Assoc. Prof. Tezcan KARTAL
Assoc. Prof. Tuğba HORZUM
Assoc. Prof. Turgut TÜRKDOĞAN
Assoc. Prof. Tülin HAŞLAMAN
Assoc. Prof. Tülin Şener KILINÇ
Assoc. Prof. Türkan ÇELİK
Assoc. Prof. Veli BATDI
Assoc. Prof. Yakup DOĞAN
Assoc. Prof. Yasemin HACIOĞLU
Assoc. Prof. Yasemin Özdem YILMAZ
Assoc. Prof. Yılmaz TONBUL
Assoc. Prof. Yusuf DEMİR
Assoc. Prof. Yücel FİDAN
Assoc. Prof. Zeliha YAZICI
Assoc. Prof. Zeynel HAYRAN
Assist. Prof. Aslı YILDIRIM
Assist. Prof. Atilla ÖZDEMİR
Assist. Prof. Ayşegül AKINCI COŞGUN
Assist. Prof. Başak KARATEKE
Assist. Prof. Begüm SERİM YILDIZ
Assist. Prof. Berrin GENÇ ERSOY
Assist. Prof. Çağla ÖNEREN ŞENDİL
Assist. Prof. Çiğdem İŞ GÜZEL
Assist. Prof. Dilruba KÜRÜM YAPICIOĞLU
Assist. Prof. Elçin EMRE AKDOĞAN
Assist. Prof. Elif BULDU
Assist. Prof. Elif MEDETOĞULLARI
Assist. Prof. Emine Gül ÇELEBİ İLHAN
Assist. Prof. Emine Hande AYDOS
Assist. Prof. Engin KARAHAN
Assist. Prof. Eren KESİM
Assist. Prof. Esra KIZILAY
Assist. Prof. Hakan TURAN
Assist. Prof. Işıl KELLEVEZİR
Assist. Prof. Kürşad DEMİRUTKU
Assist. Prof. M. EMRE SEZGİN
Assist. Prof. Melike ÜNAL GEZER
Assist. Prof. Meltem ÇENGEL SCHOVILLE
Assist. Prof. Münevver İLGÜN DİBEK
Assist. Prof. Nalan BABÜR
Assist. Prof. Nilgün KURU ALICI
Assist. Prof. Ömer KUTLU
Assist. Prof. Özlem CANARAN
Assist. Prof. Özlem CEZİKTÜRK
Assist. Prof. Özlem MELEK ERBİL KAYA
Assist. Prof. S. Burcu ÜÇOK
Assist. Prof. Selçuk TURAN
Assist. Prof. Ümit KAHRAMAN
Assist. Prof. Volkan ŞAHİN
Assist. Prof. Yurdagül BOĞAR
Assist. Prof. Zerrin TOKER
Assist. Prof. Zeynep BİLKİ
Lec. Arzu KANAT MUTLUOĞLU

Main Theme

“Designing the Future: Changing Paradigms and Transhumanism with Artificial Intelligence in Education”

Sub-Themes

- Academic freedom, autonomy, and social responsibility in education
- Artificial intelligence and educational applications
- Augmented reality applications
- Barriers to learning
- Blended learning
- Computer-assisted measurement and evaluation
- Core skill sets for students and teachers
- Design of school buildings in the future
- Designing and delivering a digital strategy
- Digital competence
- Digital parenting
- Distance Education
- Earthquake Education
- Post Earthquake Trauma Training
- Earthquake and Effective Psychosocial Intervention Methods
- Earthquake and Trauma
- The Impact of Earthquakes on School Staff
- Education and society
- Education for healthy living and healthy communities
- Education for a sustainable life
- Education in the digital age: Primary, secondary, high school, higher education, and application examples
- Educational leadership in the digital age
- Effects of regional differences on education
- Equity, Diversity, and Inclusion Related to Marginalized Groups
- Emergency Management at Schools
- Evidence-Based School Counseling Services for Refugees and Marginalized Groups
- Globalisation and Education
- Higher education
- Innovative learning designs for student success
- Instructional technologies in the digital age
- Integration of immigrants into education
- K-12 education (preschool, primary, and secondary education)
- Learning management systems
- Lifelong learning
- Machine learning
- Management information system
- Managing schools
- Measurement and evaluation of students’ learning outcomes
- Metaverse
- Migration and education
- Multicultural Classroom Concerns of Educators and Parents
- New educational system after COVID-19
- New skills to live and work in new times
- New technologies in teaching and learning

- New trends in educational research
- New trends in learning and teaching methods
- New trends in research methods
- Pedagogy, educational programs, and teaching
- Politics, good governance, and leadership in the educational sector
- Program design and development
- Promoting equality, diversity, and inclusion
- Psychological counseling and guidance in education
- Quality assurance/standards and accreditation
- Research and innovations in education
- Research ethics
- Right to an education
- Sustainable Educational Goals Related to Refugees
- Teacher education in the digital age
- The Possibility of Fundamental Changes in the Curriculum
- The role of parents in education
- The skills we need to thrive in a post-COVID-19 world
- Vocational education
- Ways to overcome the digital divide

2024 EJERCONGRESS SPONSORS

ANI YAYINCILIK
Bilimsel, kaliteli, akademik yayıncılık

ENAD ONLINE

NVIVO TÜRKİYE

BİRİKİM OKULLARI

LIBRARYTURK
E-KİTAP PLATFORMU

KOCAELİ BÜYÜKŞEHİR BELEDİYESİ
ÇALIŞINCA OLUYOR

BAŞİSKELE BELEDİYESİ
Güzel İşler

ALL CONFERENCE ALERT
ACADEMIC CONFERENCES AT A GLANCE

Başiskele Kent Konseyi

ÖZEL SEYMEN
1983
Since 1983

INTERNATIONAL CONFERENCE ALERTS

UĞUR OKULLARI
1968

DERİNCE BELEDİYESİ

MEKTEBİM KOLEJİ
Gelecek Benim
Bilgi Küpü Kampüsleri

Yeşil Doğa
Özel Eğitim ve Rehabilitasyon Merkezi

göçmen
Artisan Bakery

ENKON
Perfect Solutions

Çene suyu

Author Information

This book has been compiled with contributions from 61 authors representing 35 different universities in Turkiye, the United States, and Iran, as well as Turkiye's Ministry of National Education. Among the contributors, there are 51 authors from 31 universities 6 authors from education institutions in Turkey, 3 authors from 2 universities in the United States, and 1 author from a university in Iran.

CONTENTS

Merging Self-regulated Learning and Cooperative Learning in Mathematics: Self-regulated Jigsaw IV

Esma Nur Gözütok

Zonguldak Bülent Ecevit University, Turkiye

Ceyda Özçelik

Turkish Ministry of National Education, Turkiye

Ali Arslan

Zonguldak Bülent Ecevit University, Turkiye

Abstract

The aim of this study was to examine the effects of self-regulated Jigsaw IV on mathematics achievement, self-efficacy beliefs, and mathematics anxiety among 5th-grade students. The pretest and post-test non-equivalent control group design was utilized in the study. The participants consisted of 40 fifth graders, half of them were assigned to the experimental group, and the other half were assigned to the control group. A traditional instruction was used in the control group whereas the experimental group received the instruction based on the self-regulated Jigsaw IV technique. The intervention lasted for six weeks. An academic achievement test, a mathematics anxiety-apprehension survey, and a self-efficacy belief scale were administered as the pretest and post-test. Based on the findings, the self-regulated Jigsaw IV technique was more effective in enhancing students' math achievement and self-efficacy beliefs compared to the conventional instruction. Additionally, the technique was found to be more effective in reducing mathematics anxiety. Therefore, the Jigsaw IV integrated with self-regulated strategies is recommended to be used in the learning process.

[This paper was published in: "EJER Congress 2024 International Eurasian Educational Research Congress Conference Proceedings," Ani Publishing, 2024, pp. 166-171]

Keywords: *Mathematics education, Peer learning, Active learning, Classroom intervention, Jigsaw IV, Student motivation*

Introduction

Identifying ways to educate qualified learners is one of the contemporary concerns of education throughout the world. Therefore, students' responsibility for their own learning and active participation in the educational process is emphasized in educational settings. The cooperation among learners has positive effects on learning domains (Bandura, 1986, 1993; Dewey, 1958, 1963; Slavin, 1995; Vygotsky, 1978). Some essential skills such as problem-solving, taking responsibility, critical thinking, and analytical thinking are emphasized in the curricula. Also, teachers need to support the development of these skills in students with the help of using effective methods. One of these methods is cooperative learning, which positively affects students' academic success, interpersonal communication, and self-esteem (Johnson & Johnson, 1999, 1989). Therefore, incorporating cooperative learning strategies into the classroom is essential for fostering these vital skills.

Cooperative Learning

Cooperative learning (CL), a concept in the field of education, has been recently reviewed in educational research and practice. CL is a strategy of instruction where there is a supportive environment among students during the learning process (Johnson & Johnson, 1988, 1994; Kagan, 1994; Slavin, 1980). Referring to the views of Olsen and Kagan (1992), CL is a kind of classroom exercise in that learners construct gathered information on their own, and they are responsible for both their comprehension and the other learners. They also described CL as a planned activity conducted with groups of learners, and each of them is responsible for their learning process and contributes to the learning of other team members. Likewise, Johnson and Johnson (2002) stated that CL is an educational approach in which each student intends to enhance both his learning and the learning of the whole team. Vermette (1998) described CL as a heterogeneous team activity, and each team member is responsible for their understanding and team-mates' understanding. According to Artz and Newman (1993), group students do not sit together in problem-solving, act independently of one another, or assume responsibility for a single student. Cuseo (1992) identifies CL as a learner-centered instructional process in which heterogeneous groups of three to five students study interactively on determined objectives. Each learner is responsible for their performance, and the teacher only scaffolds the groups. The cooperative learning process is that each learner designs their learning processes by defining their ideas, discussing a subject, and generating solutions (Kuuk & Arslan, 2020). In light of these explanations, CL strategy may be considered as a tool to build significant interactions among students that improve their academic success and social interaction.

Referring to the views of Johnson and Johnson (1991), CL consists of five fundamental elements: (a) positive interdependence, in which each team member engages to manage the team objective; (b) individual accountability, in which the whole team has responsibility for both the team members learning and their learning for the benefit of group objective; (c) face-to-face promotive interaction, in which group members show respect, tolerance, and support each

other while working on the task; (d) interpersonal and small group skills, in which students possess teamwork skills required to accomplish taskwork; (e) group processing, in which students discuss the development of the group and the adjustments if required. Students are aware that when other students in the group reach their learning goals, they will also achieve their own learning goals (Arslan & Yanpar, 2006). Besides, CL signifies both the development of each learner's learning skills and the promotion of their communicative and social experiences.

Thompson (1981) stated that CL creates a student-centered atmosphere in the classroom that helps learners show higher performance and decrease their anxiety level to complete the objectives of the team. Research reveals that a positive classroom climate lessens anxiety, defeats disagreement among learners, and strengthens their sense of efficacy to encourage them to interact with their peers (Adimora et al., 2015; Bierman, 2011; Fast et al., 2010). In contrast, a competitive classroom climate causes both more anxiety for learners and a less constructive learning environment (Johnson & Johnson, 1999). High anxiety serves as an opportunity if a task is remarkably easy. However, a high level of anxiety restricts performance when tasks are different and challenging (Johnson & Johnson, 1999). CL techniques encourage learners to lower anxiety levels (Batton, 2010; Lavasani & Khandan, 2011). Moreover, it scaffolds them to develop their skills, raise self-confidence, and reduce the anxiety that occurs when communicating (Crandall, 1999; Dörnyei, 1997). So, CL supports an atmosphere where emotional resilience and academic progress are nurtured through collaborative studies.

The Jigsaw Technique

The Jigsaw technique, developed by Aronson (1978), is one of the most well-known methods of CL. While some CL techniques blend cooperative, competitive, and individualistic exercises, others focus purely on cooperation. The original Jigsaw technique combines cooperative and individualistic practices and requires all learners to actively engage in the learning process for the benefit of themselves or their team (Johnson & Johnson, 1999). In Jigsaw II, adapted by Slavin (1980), there is competition among teams, and students become experts on specific subjects, sharing their knowledge with their home teams. Jigsaw III, adapted by Kagan (1986) from Gonzales and Guerrero's (1983) version, continues to build on these foundations. Jigsaw IV includes an introductory activity and two exams after both expert group and main group studies (Holliday, 2002). These variations of the Jigsaw technique demonstrate CL's effectiveness in fostering both individual and collaborative learning.

The Jigsaw IV

The Jigsaw IV developed by Holliday stands out from other Jigsaw techniques by incorporating an introductory activity and two separate mini-exams after the expert and main group studies (Holliday, 2000, 2002). The introductory activity at the beginning of Jigsaw IV helps prepare students for the lesson and fosters their interest in the subject. Additionally, quizzes are introduced in the fourth and sixth stages to assess the accuracy of the expert sheets. A unique feature of Jigsaw IV is the optional ninth stage, which is included if re-teaching of the concept or material is necessary (Holliday, 2002). Jigsaw IV, which consists of nine stages, is applied as follows (Holliday, 2002);

In the first stage of Jigsaw IV, an introductory activity is carried out to prepare the students for the lesson and to foster their interest in the subject before starting the lesson. In the second stage, students are given expert sheets including the expertise questions, and answer them in their home groups. Then, the students leave their home groups and go to the expert groups with these sheets. Expertise groups are formed from students who answer the same expert questions. Each member of the group works on the same topic. In the third stage, students are expected to specialize in their subjects and agree on the solution to questions and problems. In the fourth stage, a quiz is conducted to check whether the expert group students learned the subject accurately. In the fifth stage, students return to their home groups and teach them the subject they learned. In the sixth stage, a quiz is applied to check whether students comprehend the subject accurately. In the seventh stage, the subjects studied are reviewed comprehensively with the whole class. The eighth stage is where students take individual responsibility and have an individual quiz. The ninth stage is not compulsory and includes re-training if it is decided that there is a poorly understood subject based on the test results.

The Self-Regulated Jigsaw IV

Arslan (2011) suggested that the Jigsaw IV technique can be supported by self-regulation skills by teaching students how to define individual subjects as learning goals, how to follow a process in achieving this goal, and how to evaluate the process and the result. During cooperative learning, students' determination of goals, distribution of tasks to achieve these goals, and evaluation of whether they achieve their goals show that they use their self-regulation skills in this process (Arslan, 2011). Özdemir and Arslan (2016) stated that the self-regulated Jigsaw IV is a practical and efficient technique to improve student achievement. Also, the study of Özdemir and Arslan (2016) conducted on higher education students, is the first publication in Turkey, to apply the self-regulated Jigsaw IV.

Aim of the Study

Cooperative learning (CL) has been widely applied in various educational contexts, ranging from primary schools to higher education. Although the literature highlights CL's positive effects on various learning domains, there is a significant gap in applying the Jigsaw IV technique specifically in mathematics education. This study aims to address this gap by examining the effects of the self-regulated Jigsaw IV technique on mathematics achievement, self-efficacy, and mathematics anxiety in 5th-grade students.

This study is essential because it examines the potential of the self-regulated Jigsaw IV technique to enhance student

performance in mathematics. This study aims to evaluate the impact of self-regulated Jigsaw IV on 5th graders' academic achievement, self-efficacy, and mathematics anxiety by integrating self-regulation strategies into the Jigsaw IV model.

Method

Design

In this study, a non-equivalent control group pretest-posttest design was used. Instruction based on curriculum was carried out in the control group, whereas the experimental group participated in instruction utilizing the self-regulated Jigsaw IV technique.

Participants

The study involved 40 fifth-grade students from a public school in Bartın Province. These participants were equally assigned into two groups: an experimental group, which engaged with the self-regulated Jigsaw IV instructional method, and a control group, which was exposed to the standard-traditional curriculum.

Instruments

An academic achievement test, a mathematics anxiety-apprehension survey, and a self-efficacy belief scale were used as the measurement instruments.

Academic Achievement Test

The test is developed to measure the competencies of students regarding the subject of natural numbers. Initially, 40 multiple-choice items were formulated, ensuring content validity through careful consideration. The question development process incorporated the expertise of two curriculum and instruction specialists along with three middle school mathematics teachers. The psychometric analyses of the test were performed using the ITEMAN software. Based on the analyses, 10 items with discrimination values below 0.30 were removed from the test. Consequently, the final form contained 30 multiple-choice items. The Cronbach Alpha of the final form was 0.91, indicating high reliability.

Self-efficacy Scale

The self-efficacy belief scale, a component of the Motivated Strategies for Learning Questionnaire (MSLQ) originally developed by Pintrich et al., (1993), was adapted into Turkish by Karadeniz vd. (2008). The original form consists of 81 items rated on a 7-point Likert scale and does not include reverse-scored items. During the Turkish adaptation, 5 items were removed. For the Turkish version of the MSLQ, item-total correlations range from .58 to .15 for the motivation dimension and from .68 to .19 for the learning strategies dimension.

Mathematics Anxiety-Apprehension Survey

The Mathematics Anxiety-Apprehension Survey (MAAS), developed by Ikegelu (1998) for middle school students, was adapted into Turkish by Özdemir and Gür (2011). The MAAS consists of 20 items. The Cronbach Alpha of the MAAS was reported as 0.91.

Process

In this study, the control group received instruction based on the standard curriculum while the experimental group underwent an intervention using the self-regulated Jigsaw IV method. Initially, daily lesson plans targeting the objectives of the 'natural numbers' unit were prepared. Students in the experimental group were then informed about the self-regulated Jigsaw technique, which included detailed instructions on course design and necessary preparations. The intervention was divided into a pretreatment phase and a posttreatment phase, spanning a total duration of six weeks.

Data Analysis

The pretest and post-test scores for both the experimental and control groups were found to be normally distributed. First, independent samples t-tests for each outcome variable were conducted to evaluate the initial comparability of the two groups. To examine whether there were significant differences between the experimental and control groups in terms of changes from pretest to post-test scores in academic achievement, self-efficacy beliefs, and anxiety, three independent samples t-tests were conducted. To ascertain the effect size of the differences observed between these scores, Cohen’s d values were calculated (Cohen, 1988).

Results

Comparison of Pretest Scores

The independent samples t-tests on the pretest scores indicated that there were no statistically significant differences between the experimental and control groups at the beginning of the study. The results were as follows: For mathematics achievement, $t(38) = -.399$, $p = .692$; for self-efficacy, $t(38) = .522$, $p = .605$; for mathematics anxiety, $t(38) = 1.595$, $p = .120$.

Comparison of Pretest Posttest Difference Scores on Mathematics Achievement

The pretest and post-test difference scores on math achievement were computed for the control group and the experimental group. Then, an independent samples t-test on the difference scores was conducted to examine whether the differences in scores were the same between experimental and control groups. The analysis demonstrated that the mean of the difference scores in math achievement for the students in the experimental group (M=15.15, SD=3.05) was higher compared to the control group (M=12.10, SD=3.45). An independent t-test yielded a statistically significant difference

between the two groups in favor of the experimental group ($t(38) = 2.96$, $p < 0.05$), with a large effect size (Cohen's d = 0.80). Thus, it can be concluded that the use of the self-regulated Jigsaw IV technique significantly enhanced students' mathematics achievement.

Comparison of Pretest Posttest Difference Scores on Self-Efficacy

The mean of differences between pretest and post-test self-efficacy scores of the experimental group (M=1.42, SD=0.90) exceeded that of the control group (M=0.24, SD=0.32). In other words, the increase in self-efficacy scores for students in the experimental group was higher than the increase in scores for students in the control group. The independent t-test analysis indicated a statistically significant difference between the groups ($t(38) = 5.54$, $p < 0.05$), associated with a large effect size (Cohen's d = 1.75). Therefore, we conclude that the self-regulated Jigsaw IV technique had a positive impact on students' self-efficacy beliefs.

Comparison of Pretest Posttest Difference Scores on Mathematics Anxiety Scores

The analysis of mathematics anxiety scores revealed that the mean difference score of the experimental group (M=0.51, SD=0.54) was higher than that of the control group (M=0.08, SD=0.12). The independent t-test showed a statistically significant difference in favour of the experimental group; $t(38) = 3.34$, $p < 0.05$, with a large effect size of Cohen's d = 1.10. In other words, the analysis showed that the decrease in mathematics anxiety scores from pretest to post-test in the experimental group is greater than the decrease observed in the control group. Thus, it can be implied that the implementation of the self-regulated Jigsaw IV technique helped students regulate their mathematics anxiety levels.

Discussion, Conclusion, and Recommendations

This study was conducted to determine the effect of the self-regulated Jigsaw IV on students' academic achievement, mathematics anxiety, and self-efficacy beliefs in mathematics class. The results showed that the academic achievement levels of the study group increased significantly compared to the pre-implementation period. This finding is consistent with the outcomes from some previous studies (Gillies, 2006; Hooper et al., 1989; Johnson et al., 2000; Thurston et al., 2010). The results obtained showed that teaching mathematics to students through the self-regulated Jigsaw IV is significantly more effective in academic achievement than teaching through traditional practices.

The results also revealed that the self-efficacy beliefs of the study group enhanced significantly compared to the pre-intervention phase. The theory of self-efficacy formed by Bandura (1977) is one of the vital determinants of the learning process. Dependently, mathematics self-efficacy is a belief in one's ability to achieve mathematics-related tasks (Schunk, 1991). The theory of Ames (1984) supported that the integration of CL into the classroom environments could have positive outcomes related to students' mathematics self-efficacy beliefs. Likewise, Ames (1984) assisted in the view that the practice of CL increased the mathematics self-efficacy of learners. Similarly, Nichols and Miller (1993) added that CL supports learners in developing math efficacy. As seen, CL implementation positively affects students' self-beliefs which is related to successfully performing tasks in mathematics. The results revealed that teaching mathematics to students through the self-regulated Jigsaw IV is significantly more effective for the development of self-efficacy beliefs than teaching through traditional practices. When the self-efficacy pretest scores of the experimental group were controlled, a significant difference was found in favor of the final test score averages of the experimental group. Therefore, the self-regulated Jigsaw IV applied in the experimental group was found to be effective in increasing students' self-efficacy beliefs. This finding was supported by previous studies (Şengül & Katrancı, 2014; Torchia, 2012). In conclusion, it is understood that the present study and the findings of other studies indicate that the use of the self-regulated Jigsaw IV may be more effective in enhancing self-efficacy beliefs of students than traditional practices in the teaching process.

The results further demonstrated that the mathematics anxiety levels of the study group decreased significantly compared to the pre-implementation period. Studies support that CL practices foster the development of positive attitudes toward the subject area and reduce anxiety (Batton, 2010; Dees, 1991; Kulik & Kulik, 1979). The results revealed that teaching mathematics to students through the self-regulated Jigsaw IV is significantly more effective in decreasing mathematics anxiety than teaching through traditional practices.

The study concluded that self-regulated Jigsaw IV may be a more effective way to enhance the self-efficacy beliefs of students than traditional practices in the teaching process. Also, the integration of CL techniques into the educational process reduces mathematics anxiety. In conclusion, CL through the jigsaw technique is a useful tool to foster students' achievements, self-efficacy beliefs, and to reduce their anxiety in mathematics. So, it is recommended that the Jigsaw IV technique embodied with self-regulated strategies may be used frequently in classrooms.

Limitation of the Study

This study has a few significant limitations. Firstly, the intervention was specifically designed for mathematics. Future research could benefit from applying the self-regulated Jigsaw IV technique in various academic areas to see if similar outcomes are achieved.

Additionally, the study was limited to fifth-grade students. It would be valuable for future studies to include participants from sixth through eighth grades. This broader approach would help determine whether the observed effects are consistent across different educational levels and enhance the overall generalizability of the results.

References

Adimora, D. E., Nwokenna, E. N., Omeje, J. C., & Eze, U. N. (2015). Influence of socio-economic status and classroom climate on mathematics anxiety of primary school pupils. *Procedia-Social and Behavioral Sciences*, 205, 693-701. https://doi.org/10.1016/j.sbspro.2015.09.108

Ames, C. (1984). Achievement attributions and self-instructions under competitive and individualistic goal structures. *Journal of Educational Psychology, 76*(3), 478–487. https://doi.org/10.1037/0022-0663.76.3.478.

Aronson, E. (1978). *The jigsaw classroom*. Sage.

Arslan, A., & Yanpar, T. (2006). Oluşturmacı (constructivist) yaklaşıma dayalı işbirliğine dayalı öğrenmenin ilköğretim sosyal bilgiler dersindeki etkileri [The effects of constructivist and collaborative learning approach on primary school social studies course]. *Eurasian Journal of Educational Research, 24*,22–32. https://www.researchgate.net/publication/286916621

Arslan, A. (2011). Ayrılıp birleşme IV tekniğinin erişiye, öz yeterlik inancına ve öz düzenleme becerisine etkisi [The effect of jigsaw IV on gains, self efficacy belief and self regulation skill]. *Uluslararası Yönetim İktisat ve İşletme Dergisi, 7*(13), 369–385. https://dergipark.org.tr/en/pub/ijmeb/issue/54852/751155

Artz, A. F., & Newman, C. M. (1993). *How to use cooperative learning in the mathematics class* (3rd ed.). National Council of Teachers of Mathematics. https://eric.ed.gov/?id=ED418883

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191-215. https://doi.org/10.1037/0033-295X.84.2.191

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Prentice Hall.

Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational Psychologist, 28*(2), 117-148. https://doi.org/10.1207/s15326985ep2802_3

Batton, M. (2010). *The effect of cooperative groups on math anxiety* (Doctoral dissertation, Walden University). ProQuest Digital Dissertations. https://scholarworks.waldenu.edu/dissertations/822

Bierman, K. L. (2011). The promise and potential of studying the "invisible hand" of teacher influence on peer relations and student outcomes: A commentary. *Journal of Applied Developmental Psychology, 32*(5), 297–303. https://doi.org/10.1016/j.appdev.2011.04.004

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Erlbaum.

Crandall, J. J. (1999). Cooperative learning and affective factors. In J. Arnold (Ed.), *Affect in language learning* (pp. 226–245). Cambridge University Press.

Cuseo, J. (1992). Collaborative and cooperative learning in higher education: A proposed taxonomy. *Cooperative Learning and College Teaching, 2*(2), 2-4.

Dees, R. L. (1991). The role of cooperative learning in increasing problem-solving ability in a college remedial course. *Journal for Research in Mathematics Education*, *22*(5), 409-421. https://doi.org/10.2307/749188

Dewey, J. (1958). *Experience and nature*. Dover.

Dewey, J. (1963). *Experience and education*. Collier Books.

Dörnyei, Z. (1997). Psychological processes in cooperative language learning: Group dynamics and motivation. *The Modern Language Journal*, *81*, 482-493. https://doi.org/10.1111/j.1540-4781.1997.tb05515.x

Fast, L. A., Lewis, J. L., Bryant, M. J., Bocian, K. A., Cardullo, R. A., Rettig, M., & Hammond, K. A. (2010). Does math self-efficacy mediate the effect of the perceived classroom environment on standardized math test performance? *Journal of Educational Psychology, 102*(3), 729–740. https://doi.org/10.1037/a0018863

Gillies, R. (2006). Teachers' and students' verbal behaviors during cooperative and small-group learning. *British Journal of Educational Psychology, 76*(2), 271-287. https://doi.org/10.1348/000709905X52337

Gonzalez, A., & Guerrero, M. (1983). *Jigsaw teacher's handbook*. Hollister Unified School District.

Hooper, S., Ward, T., Hannafin, M., & Clark, H. (1989). The effects of aptitude composition on achievement during small group learning. *Journal of Computer-Based Instruction*, *16*, 102–109.

Ikegulu, T. N. (1998). *An empirical development of an instrument to assess mathematics anxiety and apprehension* (ERIC Document No. ED 433235). ERIC. https://eric.ed.gov/?id=ED433235

Johnson, R. T. & Johnson. D. W. (1988). Cooperative learning: Two heads learn better than one. *Transforming Education*, *18*. 34-36.

Johnson, D. W., & Johnson, R. T. (1989). *Cooperation and competition: Theory and research*. Interaction Book Company.

Johnson, D. W., & Johnson, F. (1991). *Joining together: Group theory and group skills* (4th ed.). Prentice Hall.

Johnson, D. W. & Johnson, R. T. (1994). *Learning Together and Alone: Cooperative, Competitive, and Individualistic Learning* (4th ed.). Allyn & Bacon.

Johnson, D. W., & Johnson, R. (1999). *Learning together and alone: Cooperation, competition, and individualization* (5th ed.). Allyn & Bacon.

Johnson, D. W., Johnson, R. T., & Stanne, M. B. (2000). *Cooperative learning methods: A meta-analysis*. University of Minnesota.

Johnson, D. W., & Johnson, R. T. (2002). Cooperative learning and social interdependence theory. In R. S. Tindale, L. Heath, J. Edwards, E. J. Posavac, F. B. Bryant, Y. Suarez-Balcazar, E. Henderson-King, & J. Myers (Eds.), *Theory and research on small groups* (pp. 9–35). Springer. https://doi.org/10.1007/0-306-47144-2_2

Kagan, S. (1986). Cooperative learning and sociological factors in schooling. In C. E. Cortes (Ed.), *Beyond language: Social and cultural factors in schooling language minority students* (pp. 231–247). California State University, Evaluation, Dissemination, and Assessment Center.

Kagan, S. (1994). *Cooperative learning*. Kagan Cooperative Learning.

Karadeniz, S., Buyukozturk, S., Akgun, O. E., Cakmak, E. K., & Demirel, F. (2008). The Turkish adaptation study of motivated strategies for learning questionnaire (MSLQ) for 12-18 year old children: Results of confirmatory factor analysis. *Online Submission*, *7*(4).

Kulik, J. A., & Kulik, C. L. (1979). College teaching. In Peterson and Walberg (Eds.), *Research in teaching: Concepts, findings and implications*. McCutcheon Publishing.

Kuuk, Ö., & Arslan, A. (2020). Cooperative learning in developing positive attitudes and reflective thinking skills of high school students in English course. *International Journal of Psycho-Educational Sciences*, *9*(1), 83-96.

Lavasani, M. G., & Khandan, F. (2011). The effect of cooperative learning on mathematics anxiety and help-seeking behavior. *Procedia - Social and Behavioral Sciences, 15*, 271–276. https://doi.org/10.1016/j.sbspro.2011.03.085

Nichols, J. D., & Miller, R. B. (1994). Cooperative learning and student motivation. *Contemporary Educational Psychology, 19*(2), 167–178. https://doi.org/10.1006/ceps.1994.1015

Olsen, R., & Kagan, S. (1992). About cooperative learning. In C. Kessler (Ed.), *Cooperative language learning: A teacher's resource book* (pp. 1-30). Prentice Hall.

Özdemir, E., & Arslan, A. (2016). The effect of self-regulated Jigsaw IV on university students' academic achievements and attitudes towards English course. *Journal of Education and Training Studies, 4*(5), 173–182. https://doi.org/10.11114/jets.v4i5.1453

Özdemir, E., & Gür, H. (2011). Matematik kaygısı-endişesi ölçeğinin (MKEÖ) geçerlilik ve güvenirlik çalışması. *Eğitim ve Bilim*, *36*(161), 39-50.

Pintrich, P. R., Smith, D. A. F., Garcia, T., & McKeachie, W. J. (1993). Reliability and predictive validity of the Motivated Strategies for Learning Questionnaire (MSLQ). *Educational and Psychological Measurement, 53*(3), 801–813. https://doi.org/10.1177/0013164493053003024

Schunk, D. H. (1991). Self-efficacy and academic motivation. *Educational Psychologist, 26*(3–4), 207–231. https://doi.org/10.1080/00461520.1991.9653133

Slavin, R. E. (1980). Cooperative learning. *Review of Educational Research*, *50*(2), 315-342. https://doi.org/10.2307/1170149

Slavin, R. E. (1995). *Cooperative learning: Theory, research, and practice* (2nd ed.). Allyn & Bacon.

Şengül, S., & Katrancı, Y. (2014). Effects of jigsaw technique on mathematics self-efficacy perceptions of seventh grade primary school students. *Procedia-Social and Behavioral Sciences*, *116*, 333-338. https://doi.org/10.1016/j.sbspro.2014.01.217

Thompson, S. C. (1981). Will it hurt less if I control it? A complex answer to a simple question. *Psychological Bulletin, 90*(1), 89-101. https://doi.org/10.1037/0033-2909.90.1.89

Thurston, A., Topping, K. J., Tolmie, A., Christie, D., Karagiannidou, E., & Murray, P. (2010). Cooperative learning in science: Follow-up from primary to high school. *International Journal of Science Education*, *32*(4), 501-522. https://doi.org/10.1080/09500690902721673

Torchia, S. P. (2012). *Cooperative learning and its effect on fourth-grade mathematics students' achievement, motivation, and self-efficacy* (Unpublished doctoral dissertation). Capella University.

Vermette, P. J. (1998). *Making cooperative learning work—Student teams in K-12 classroom*. Prentice Hall.

Vygotsky, L. S. (1978). *Mind in society* (M. Cole, V. John-Steiner, S. Scribner, & E. Sauberman, Eds.). Harvard University Press.